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Jahnula aquatica and its anamorph *Xylomyces chlamydosporus* on submerged wood in Thailand

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Abstract — Single ascospore isolates of *Jahnula aquatica* germinated to give rise to the anamorphic fungus *Xylomyces chlamydosporus*. This is the first confirmed connection between a *Jahnula* species and the anamorphic genus *Xylomyces*. Colony morphology and sporulation of *Xylomyces* in culture are reported, with also a fungal list of *Jahnula* and related genera found in Thailand.

Key words — anamorph-teleomorph connection, freshwater *Ascomycota*, lignicolous

Introduction

In an ongoing study of freshwater lignicolous fungi in Thailand, natural wood from various locations was collected and yielded a number of *Jahnula* spp. Of these, a strain of *Jahnula aquatica* (BCC21544) contaminated by bacteria on CMA gave rise to chlamydospores and was identified as *Xylomyces chlamydosporus*. The order *Jahnulales* (Pang et al. 2002) comprises five teleomorphic genera and three anamorphic genera (*Brachiosphaera, Speiropsis, Xylomyces*), but no specific anamorph-teleomorph connections have been made (Campbell et al. 2007). Eight *Xylomyces* taxa have been described, all from freshwater except for *X. rhizophorae* (Kohlmeyer & Volkmann-Kohlmeyer 1998), which occurs on senescent mangrove wood of *Rhizophora*. This is the first confirmed account of the connection of a *Jahnula* species to its anamorph and is described and illustrated herein.

Materials & methods

Dead, decorticated, and barked twigs and wood were collected at a stream in Mu Ko Chang National Park, Trat province, Thailand. On return to the laboratory samples were washed, incubated in sterile plastic boxes on a layer of moist, sterile, tissue paper, and periodically examined for fungi using a stereomicroscope. After the fungi were isolated

and identified, preparations were mounted in lactophenol-cotton blue and sealed with polyvinyl alcohol.

Single-ascospore isolates of *Jahnula aquatica* were prepared by spreading ascospores over Corn Meal Agar (CMA) surface with a flame-sterilized inoculation loop dipped in 0.05% (w/v) Triton X-100. Plates were incubated at 20°C in a cabinet with cool white fluorescent light and daily examined with a microscope for signs of germination. Six to eight germinated ascospores were transferred to new plates and incubated in the same cabinet. After isolation, specimens were dried down and deposited in the BIOTEC Bangkok Herbarium (BBH); live cultures are maintained in the BIOTEC Culture Collection (BCC).

Taxonomy

Jahnula aquatica (Kirschst.) Kirschst., Ann. Mycol. 34: 196. 1936. Figs. 1–6

MycoBank MB 257114

≡ *Amphisphaeria aquatica* Plöttn. & Kirschst., Verh. Bot. Ver. Prov. Brandenb. 48: 52. 1906, nom. illegit., non (Ellis & Everh.) Berl. & Voglino 1886.

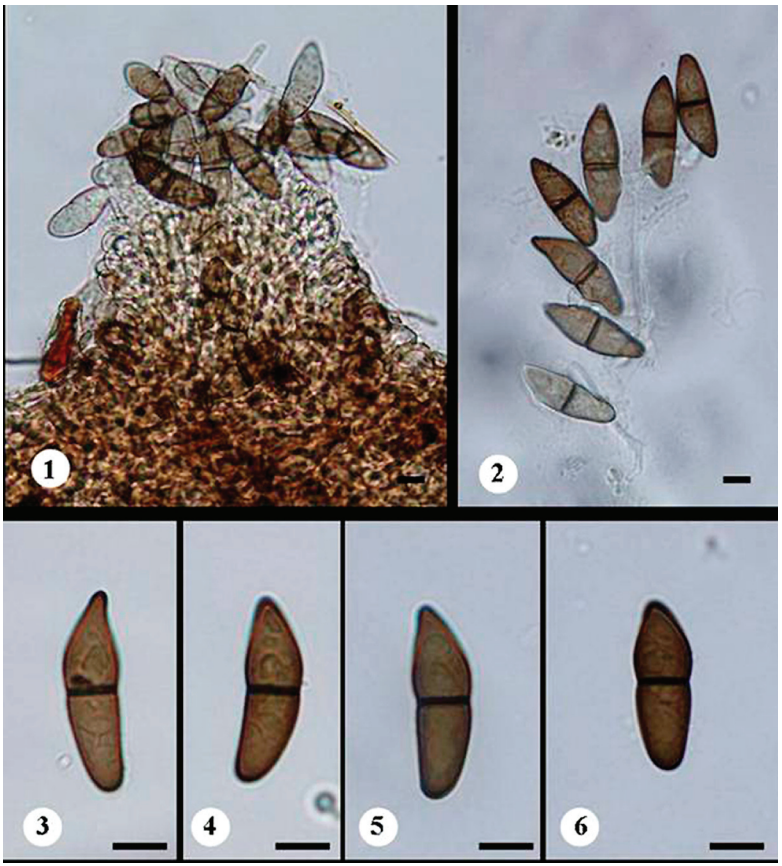
≡ *Melanopsamma aquatica* Kirschst., Krypt. Fl. Brandenb. 7(2): 226. 1911.

Anam.: *Xylomyces chlamydosporus* Goos, R.D. Brooks & Lamore, Mycologia 69: 282. 1977.

Ascomata 345–380 × 265–330 µm, hyaline when young, becoming translucent black with age, membranous, globose to subglobose, ostiolate, papillate, superficial to partially immersed in wood, scattered, attached to adjacent ascomata by broad, brown, superficial, stoloniferous hyphae. Neck 60–95 × 74–80 µm, periphysate; periphyses short, hyaline (Figs. 1). Peridium 20–30 mm wide, of textura angularis in surface view, in longitudinal section peridial wall 3–4 cell layers wide, composed of an outermost layer of large, moderately thick-walled brown cells, and an inner layer of elongated, flattened, thin-walled hyaline cells. Pseudoparaphyses septate, narrow, 1.5–2 µm wide, hyaline, filiform, branched and anastomosing above the asci. Asci 170–200 × 15–18 µm, fissitunicate, cylindrical, pedicellate, with an apical chamber and eight, overlapping uniseriate ascospores. Ascospores (28–)33–40 × (8–)11–12 µm, brown to dark brown, ellipsoidal-fusiform, 1-septate, constricted at the septum, upper cell broader than basal cell, multiguttulate, without a gelatinous sheath or appendages (Figs. 2–6).

Anamorph: The anamorph is identified by the lack of conidiophores and the production of abundant chlamydospores. Colonies on CMA slow growing, dark brown to black, effuse; hyphae thick-walled, septate, constricted at the septa; hyphal cells cylindrical to subglobose; after a month bacteria-contaminated colonies developed chlamydospores that were fusiform, intercalary, straight or curved, solitary or in chains (95–420 × 26–42 µm), occasionally branched, with thickened septa, constricted at the septa, dark brown to blackish, end cells paler (Figs. 7–10).

Habitat: Saprobic on submerged natural wood in a stream.

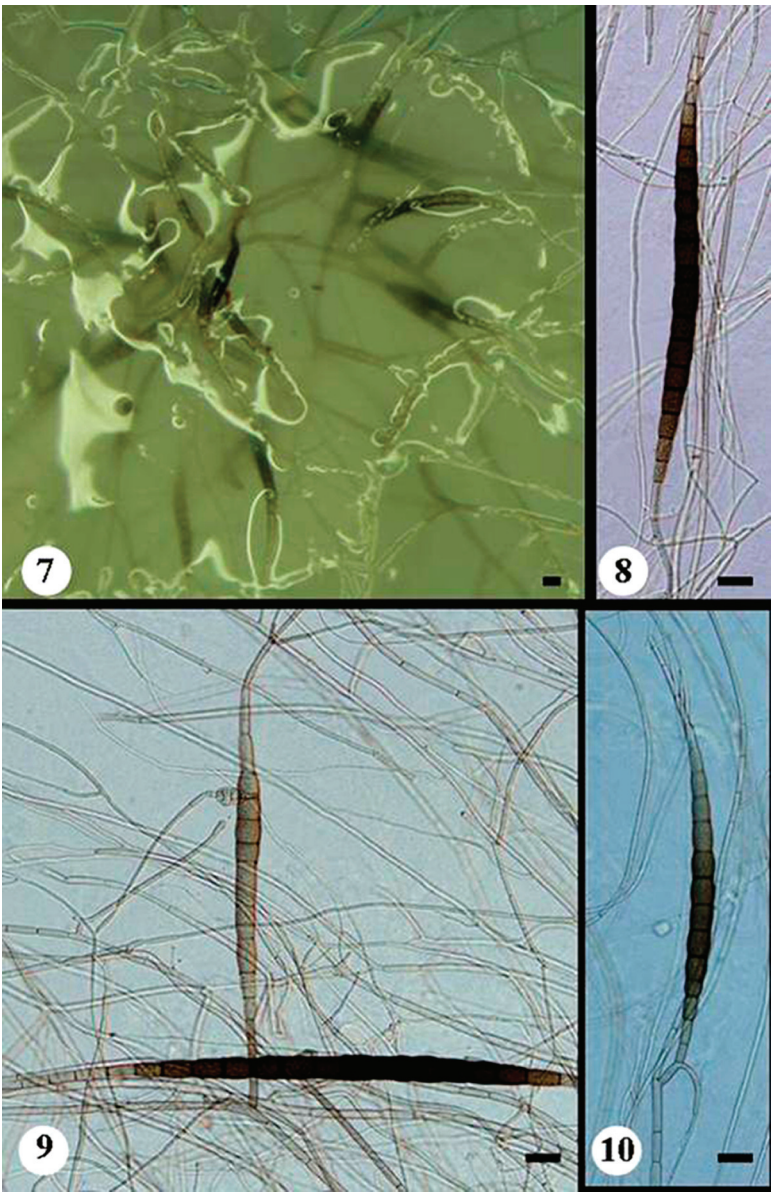


Figs. 1–6. *Jahnula aquatica.* (BCC 21544). 1. Ascospores mass at the ostiole. 2. Ascospores. 3–6. Ellipsoidal-fusiform ascospores. Scale bars = 10 µm.

Specimen examined: **Thailand**. **Trat:** Mu Ko Chang National Park, Khlong Phlu Waterfall on submerged natural wood, 3 April 2006, *Somsak Sivichai* & *Veera Sri-Indrasutdhi,* BIOTEC SS3895.

Geographical distribution: Germany, Hong Kong, South Africa, Thailand, USA (IL, TN).

Comments: The collection of *Jahnula aquatica* is in accord with other descriptions of this species (Hawksworth 1984; Hyde & Wong 1999; Raja & Shearer 2006), except no anamorph was reported previously. Unlike some other members of the genus, the ascomata are immersed in the substratum or superficial (lacking long stalks), and the ascospores lack a gelatinous sheath or appendages (Figs. 2–6) (Raja & Shearer 2006).



Figs. 7–10. *Xylomyces chlamydosporus* produced from *Jahnula aquatica* ascospores. 7. Chlamydospores produced on CMA contaminated by bacteria. 8–10. Chlamydospores produced on CMA. Scale bars = 10 μm.

Xylomyces chlamydosporus was described by Goos et al. (1977) from submerged wood in Rhode Island, U.S.A.; Goh et al. (1997) reported four different *Xylomyces* species also on submerged wood in freshwater streams. No teleomorph has been described for any of these. *Xylomyces* was referred to the *Jahnulales* based on the wide mycelium and molecular evidence (Campbell et al., 2007), but no connection has previously been made to a specific *Jahnula* species. Our study confirms that *X. chlamydosporus* has been correctly referred to the *Jahnulales,* with *J. aquatica* supported as its teleomorph.

The taxa in the *Jahnulales* that have been collected in tropical streams of Thailand are listed in Table 1.

Table 1. List of species of *Jahnula* and related genera collected in Thailand

Species	Ascospores (sheath or polar pad)	References
Aliquandostipite khaoyaiensis Inderb.	Thick sheath	Inderbitzin et al. 2001
A. siamensiae (Sivichai & E.B.G. Jones) J. Campb. et al.	–	Campbell et al. 2007
Jahnula appendiculata Pinruan et al.	Thick sheath & appendages	Pinruan et al. 2002
J. aquatica (Kirschst.) Kirschst.	–	Current study
J. australiensis K.D. Hyde	–	Current study
J. bipolaris (K.D. Hyde) K.D. Hyde	Polar pad	Current study
J. granulosa K.D. Hyde & S.W. Wong	Thin sheath	Current study
J. seychellensis K.D. Hyde & S.W. Wong	Polar pad	Current study
J. morakotii Sivichai & Boonyuen	–	Sivichai & Boonyuen 2010
Megalohypha aqua-dulces A. Ferrer & Shearer	–	Ferrer et al. 2007

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